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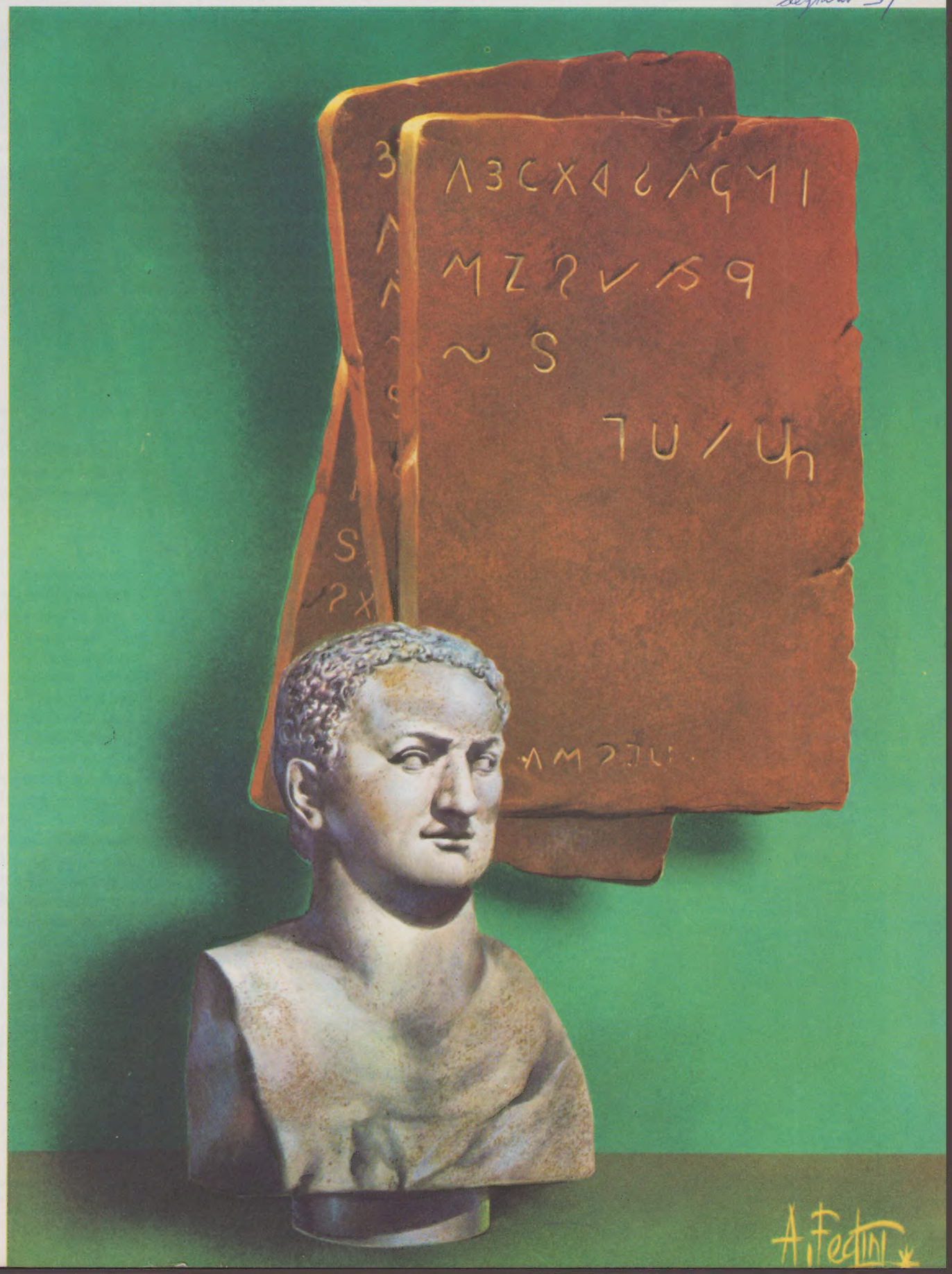

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*This issue contains the contents for Volume 16.*

# SECRETARIAL WORK (part one)

A WOMAN'S place used to be in the home. Nowadays if all the women stayed at home the worlds of government and business would grind to a halt. Helpless men would wallow among piles of unanswered and unfiled letters; telephones would ring unanswered; appointments would not be kept. For women, as secretaries, are essential to the administrative life of the world. The secretary's job is to take as much routine work as possible off the shoulders of her employer, thereby giving him more time to devote to important and specialised matters. She needs to be tactful, efficient, discreet, and able to work at great speed, often on her own initiative. Before she can do all this she has probably spent some months learning how to use the many fast-working office machines now available, and, most important of all, mastering the two basic skills of typewriting and shorthand. Shorthand enables her to put down words or thoughts as fast as they are formed and is equally valuable to journalists, students, court reporters, and many others. Typewriting provides a quickly written but clearly legible record. A good secretary is one who can combine speed with accuracy and reliability. She is a jewel to be prized and kept.

## What is a secretary?

The word secretary means both a confidant and a person who writes for another. Both these descriptions have been true of secretaries since their appearance thousands of years ago – for there have been secretaries since man first devised a means of writing. For many centuries few people were able to read and write, and the secretaries, who had these skills, often became very important people. They wrote letters, kept records and accounts, and by doing this had detailed knowledge of everything their employers did.

In Ancient Egypt, 4,000 years ago, the scribes were the most important people after the Pharaoh and the priests; the highest positions were open to them. In Roman times the *secretarius* (from which our word secretary is derived) was a confidential employee and a trusted friend. The high and trusted positions which secretaries have held since the Middle Ages are reflected today in official titles, such as Secretary of State, Foreign Secretary, and Secretary-General of the United Nations.

*Early shorthand – a bronze coin, dating from* A D 33: Agrippina, Marci Filia Mater Cai Caesaris Augusti (*Agrippina, daughter of Marcus, mother of Caius Caesar Augustus*). *On the reverse,* S P Q R, Senatus Populusque Romanus (*The Senate and the Roman people*)

*Shorthand has many other uses besides secretarial work – here reporters use it to record an interview*

*Previous page:* Clay tablets on which the first shorthand alphabet, invented by Cicero's slave, Tiro, has been scratched. *Below*, a bust of the Emperor Titus, one of the many great Romans who practised Tiro's shorthand.

# CELESTIAL BODIES (part one)

*Pluto is discovered – two photographs of the night sky, taken at a few days' interval, show that one 'star' has moved*

FROM the very earliest times men have looked up at the starry heavens and wondered what the myriad points of light that they saw there really were. They noticed that certain 'stars' moved in relation to the unchanging pattern of the constellations, and they called these moving 'stars' the 'wandering ones'. We now know, of course, that they are planets.

A star is a gigantic sphere of gas; a planet is much smaller and solid. A planet does not shine with its own light, and when we see Jupiter 'shining' in the night sky we are really seeing sunlight reflected from its surface. Stars are much brighter than planets – as bright as, or even brighter than, our Sun. Yet to us stars appear no brighter than planets, because they are much farther away. Of the planets, Mars, Venus, and Jupiter are easy to see, but the distant ones, Uranus, Neptune, and Pluto, are faint. Pluto was discovered only in 1930 when two photographs of the same part of the sky, taken within a few nights of each other, revealed that one 'star' had moved.

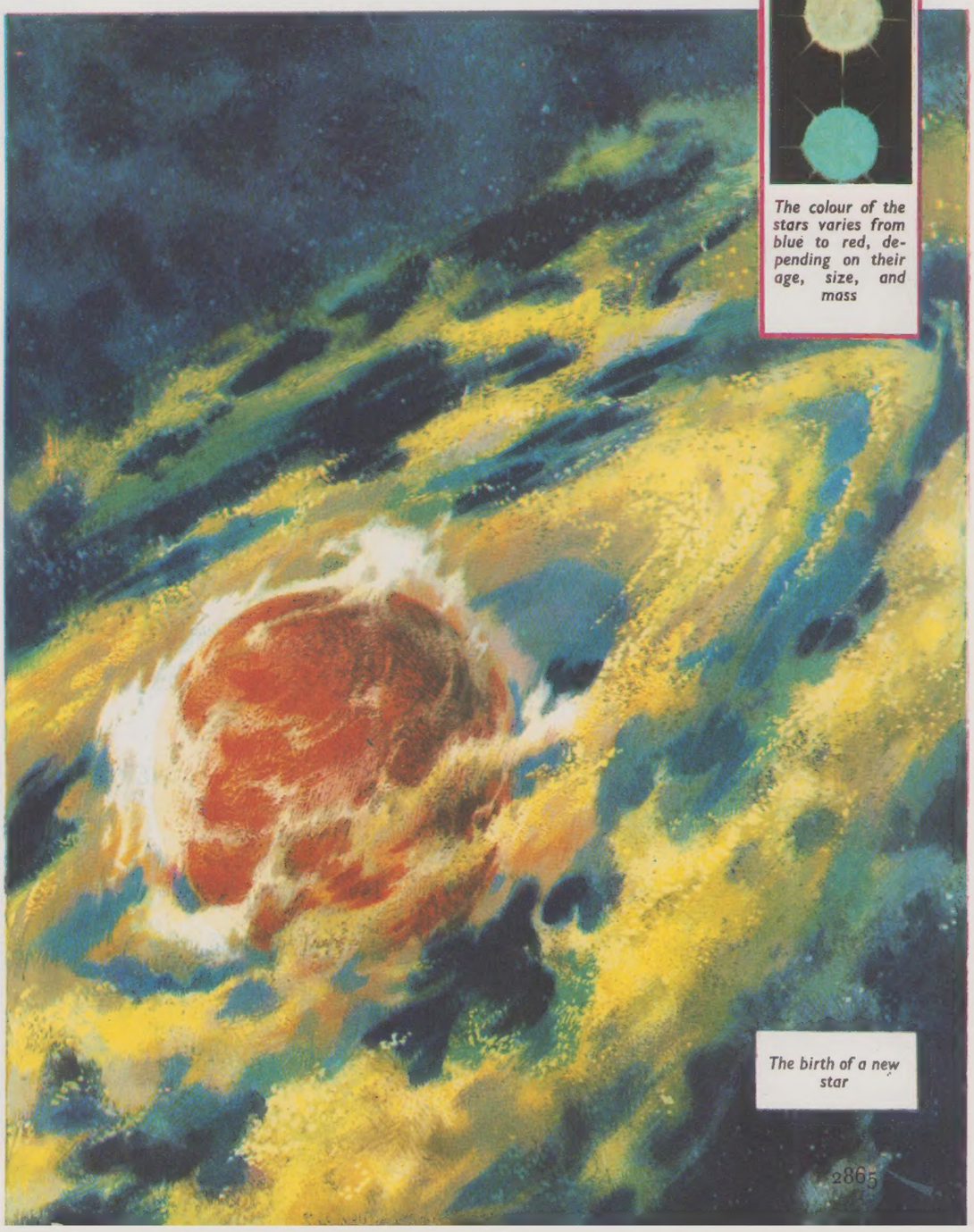
## The density of the Universe

When we look up at the sky on a clear frosty night we can see thousands of stars. A telescope will reveal millions upon millions more, each a giant ball of gas like our Sun. Despite these vast numbers of stars the Universe is not crowded; each star is separated from its neighbours by immense distances. If we imagine all the atoms in all the stars spread out evenly in space there would only be one atom in every 4,000 cubic feet of space. (There are 1,500,000 million million million atoms in a cubic *inch* of water!)

## The life of a star

The stars are the most important inhabitants of our Universe, for without them there would be no heat or light. Each star is continually giving out an enormous amount of energy which is derived from nuclear reactions occurring deep in its interior. Stars are by no means all identical; they vary in size, colour, brightness, and temperature.

*The colour of the stars varies from blue to red, depending on their age, size, and mass*

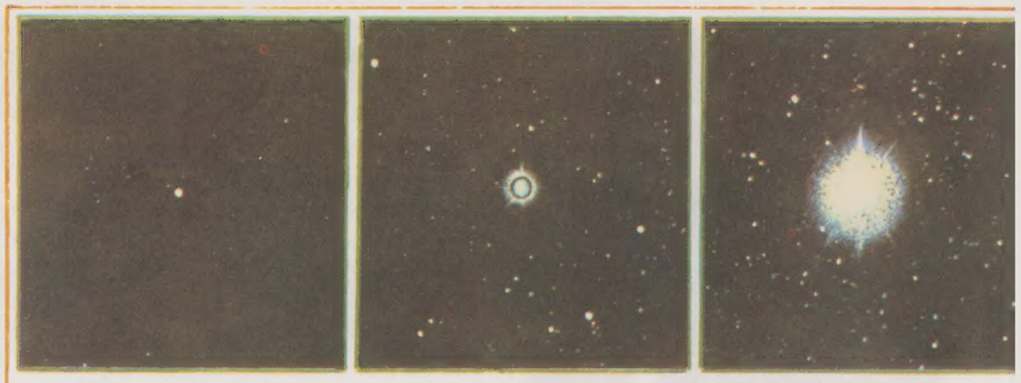


*The birth of a new star*

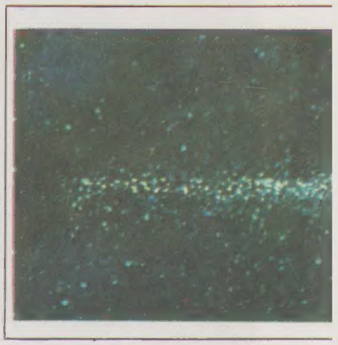
Our Sun is an average star and in no way outstanding. The stars seem ageless, and indeed they are when compared with the age of the human race. Even so, each star must have a beginning and eventually an end.

A star begins life as a vast, formless cloud of hydrogen gas and dust. This cloud begins to shrink and rotate. As it shrinks the temperature at its centre increases, and in due course an incandescent ball of gas is formed – a young star. When the temperature at its centre reaches 10 to 20 million degrees Centigrade the hydrogen gradually changes into helium through nuclear reactions. The star uses its hydrogen for thousands of millions of years, during which time little or no change can be seen on its surface. The Sun is at this stage of its life now; it has been using up its hydrogen for about 4,000 million years.

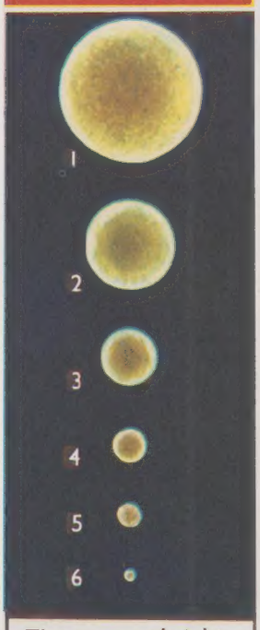
Eventually most of the hydrogen is changed into helium, and the star then increases in brightness and size; its radius may increase by up to 300 times. It also becomes brighter and redder, and is known as a 'red giant'. At this point in its life the star may explode suddenly in a matter of minutes, sending its outer layers flying off into space; it is then called a 'nova'. But soon this 'fit of bad temper' ends, and the star cools down to become a 'white dwarf'. A typical white dwarf is no larger than Jupiter but it is 1,000 times as heavy; one cubic inch of its material would weigh half a ton. The lifetime of a star varies from one million to 10 million million years, depending on its original size and brightness. It is estimated that the Sun's life will be about 10,000 million years, so it has over 5,000 million years to go before it starts to expand and explodes.



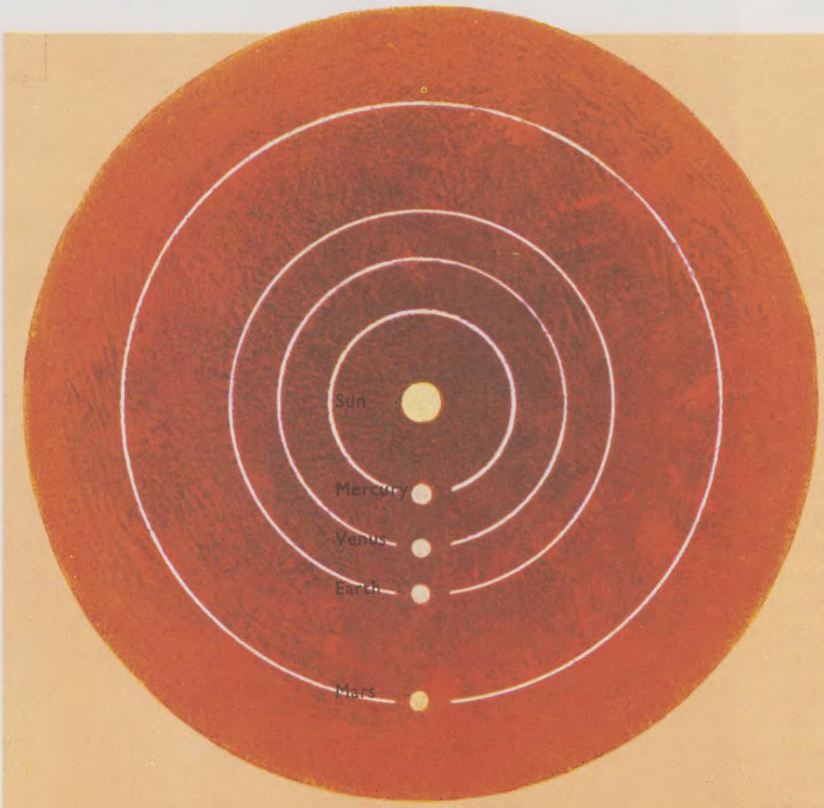
*Part of the sky, seen first with the naked eye, and then through telescopes of increasing magnitude. In the first which is between the first and sixth magnitudes, is visible. By using increasingly powerful telescopes we can see and 18th magnitudes. Imperfections in the telescopes' lenses blur the central star*



THE 'MAGNITUDE' OF STARS




The apparent brightness of a star is called its *stellar magnitude*. The brightest stars are said to have a magnitude of 1 and those just visible to the naked eye a magnitude of 6. The area of each disc shown above is proportional to the brightness of the star.




*Antares could contain our whole Solar System up to the orbit of Mars*

## STARS LARGE AND SMALL

Like pebbles on a beach, stars are all different. The white dwarfs are the smallest, densest stars. They are minute compared with giant stars like Aldebaran. If Aldebaran were put into our Solar System in place of the Sun it would almost engulf the planet Mercury. Even larger is the 'supergiant' Antares, which has a diameter of 210 million miles and could contain our whole Solar System up to the orbit of Mars. These giant stars have very low densities, with the result that, although they are very much larger than the Sun, their total mass is not very different from the Sun's mass.

All stars are not alone and isolated in space like our Sun. About half the stars we see are members of *binary* or *triple* systems; that is, two or three stars revolve around one another, sometimes slowly and sometimes at very high speeds. Nor do all stars shine at a constant rate – the Cepheid variable stars, for example, change their brightness over a period as short as one day. If our Sun were one of this type, we should have to plan our days according to whether the Sun would be bright or dim at a particular time.

## STARS AND GALAXIES

Not all the points of light in the night sky are single stars or planets. A number are groups of stars making up *globular clusters*; there may be as many as 100,000 stars in some clusters. Others are galaxies – enormous star systems, sometimes shaped like flat discs and sometimes like rugby footballs. Powerful optical telescopes have revealed thousands of millions of gal-

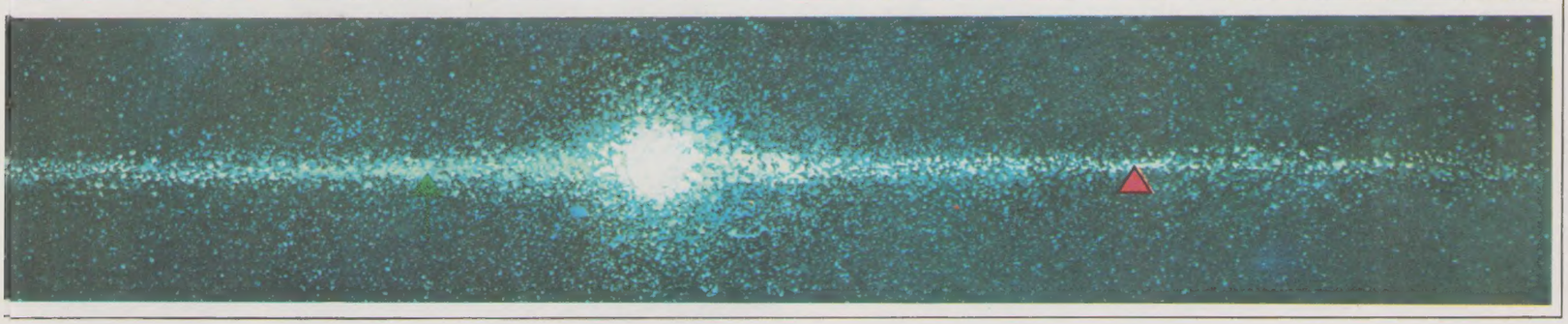
picture the central star, stars of the 12th, 15th,

## Our galaxy

The Solar System and most of the stars which it is possible for us to see with the naked eye belong to our galaxy, which is shown in the illustration below. Our galaxy is shaped like a flat wheel or disc with a hub or nucleus at its centre. It is so vast that its size must be measured in light-years rather than miles (one light-year is about 6 million million miles). The diameter of the disc is about 90,000 light-years, and the nucleus of the galaxy is about 16,000 light-years in diameter.

The Sun lies about three-fifths of the way (or 27,000 light-years) from the centre. The stars are not arranged at random in the disc, but are grouped together in spiral arms, so that from above the galaxy would look like a giant catherine wheel. And indeed, like a catherine wheel, the galaxy is spinning about its centre. The Sun revolves at a speed of 140 miles a second, but even at this fantastic speed it takes 200 million years to complete one revolution. This means that since the Sun was formed it has completed about 20 revolutions.

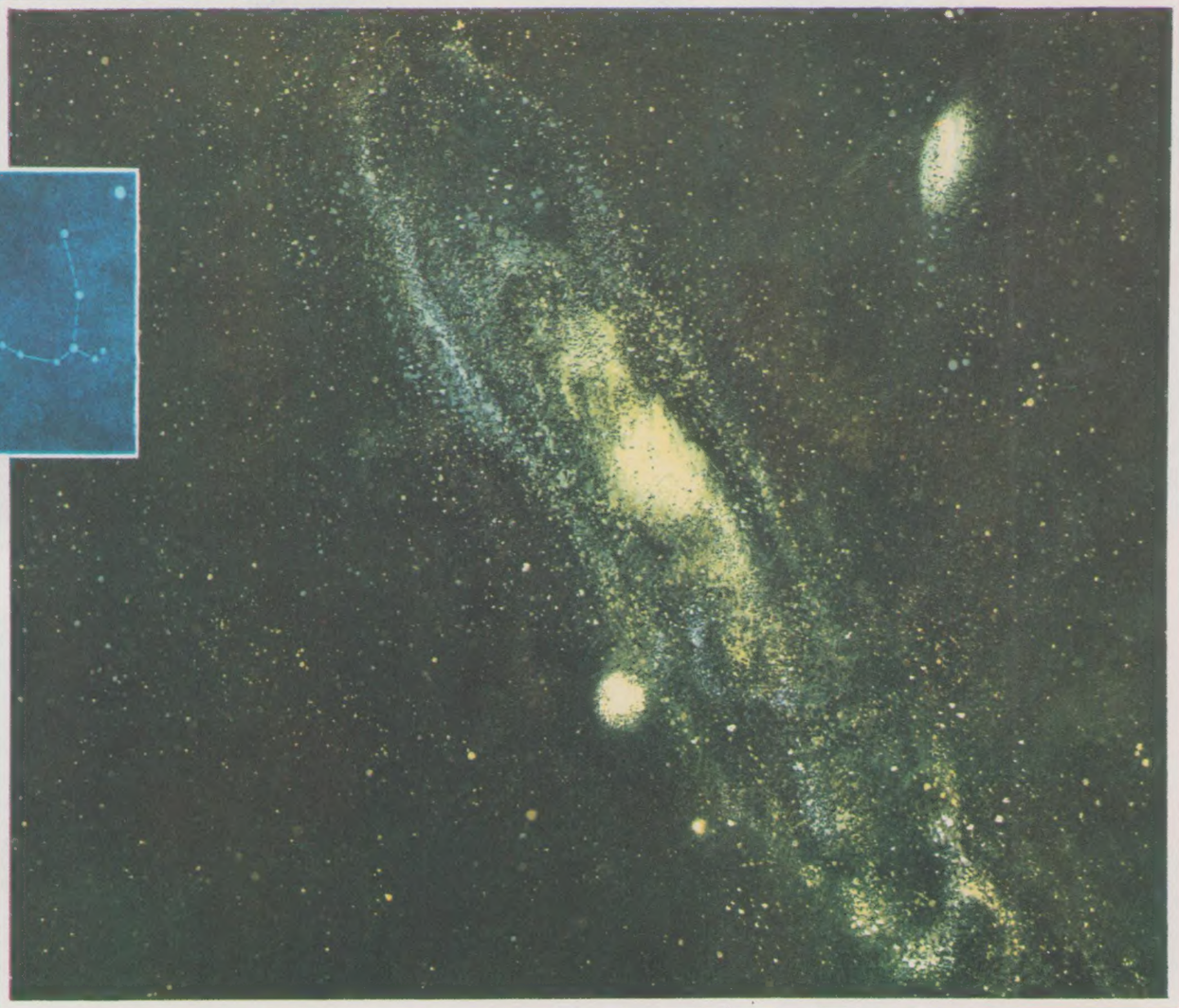
The galaxy contains about 200,000 million stars, each of which has an average mass of about 2,000 million million million million tons. The galaxy is very heavy but also vast – in fact, it is mostly empty space. In addition to the stars, the galaxy contains large clouds of dust and gas from which future stars may condense.



*A side view of our galaxy; the position of the Sun is shown by an arrow*

*The Andromeda Nebula*

*How the Andromeda Nebula (arrowed) appears to us from Earth at certain times of the year*



axies, each containing about 200,000 million stars. The Sun is one star among millions in our own galaxy. The nearest galaxy to ours, the Andromeda Nebula (on the right), lies 4,500,000 million million miles away.

# HOW ANIMALS CARRY THINGS

WHEN you or I want to lift or carry something from one place to another we simply pick it up in our hands without having to think about the matter at all. Some animals – especially our nearest relatives the apes and monkeys – act in the same way, but most of them are not nearly as well equipped for carrying things as we are. Before we enquire into how animals solve this problem, let us consider what sort of things they carry, and why.

First, many animals convey food from one place to another instead of just eating it on the spot; they generally do this either to make a store or to feed their young. We encounter instances of this among the insects: ants and wasps bring great quantities of food back to their nests to feed their larvae, carrying it in their jaws; and bees collect the nectar from flowers and bring it back to the hive in their stomachs to make honey. Secondly, animals often carry their young from place to place; this is also true of ants, but of no other insects. The third kind of load is nesting material, and here again ants and wasps carry this.

It is, however, among the higher animals – the mammals and birds – that the activity of carrying is most general, and we shall now consider how they set about it.

*Mammals that carry their young in their mouths*

## Mammals

One of the most distinctive features of the mammals is the care they take of their young; many of them will convey their babies to a place of safety if danger threatens, or even carry them about with them wherever they go. The young of carnivorous mammals are always helpless for some time after birth, and their mothers carry them, when necessary, in their mouths. Some rodents also carry their young in this way. The pictures on the left show how the dog ①, the cat ②, the bear ③, and the squirrel ④ carry their babies. All these animals have sharp teeth, but they never hurt their children when they pick them up.

Some mammals carry their young on their backs. The anteater and pangolin do this, and many of the marsupials (see page 2801) carry their babies in this way after they have left the pouch. Monkeys also carry their young until they can run or climb unaided. In the large illustration we show five mammals carrying their babies on their backs: the baboon ⑤, the koala ⑥, the opossum ⑦, the great anteater ⑧, and the pangolin ⑨. Of these ⑥ and ⑦ are marsupials.

The picking up and carrying of materials by animals is well demonstrated by the rodents. The North American wood rat ⑩ has a mania for collecting objects of various kinds, especially things which are brightly shining or coloured, which it piles around its nest.

The greatest 'engineer' among the mammals is the beaver. A family of beavers makes a dam of branches, packed with mud and stones, across a stream, and then constructs a 'house' of sticks in the resultant pond. To obtain timber beavers cut down trees with their teeth, and then drag the branches into the stream with their jaws and fore-paws. When transporting mud and stones they generally clasp the materials in their arms ⑪, but they sometimes carry such materials on their flat tails. The European hamster ⑫ makes a store of food for its winter hibernation period. When collecting material for this purpose it stuffs its cheeks with seeds and grain, and in this way carries it to its burrow.

*In this picture a number of animals are shown carrying their young,*

*their food, or other materials. For convenience we have put them all into one landscape*

## Birds

The practice of carrying their young is not nearly so common among birds as mammals, but it is occasionally seen; the mother swan ⑬ will sometimes play the part of a living boat and carry her young babies on her back, but they soon learn to swim on their own. Birds of prey, such as eagles and hawks, use their powerful claws to carry both nesting materials ⑭ and the bodies of their prey ⑮. The eagle's claws are so strong that it can crush the life out of a hare almost instantly. Most birds carry nesting materials in their beaks. The sparrow ⑯ collects this on the ground, but swifts and swallows ⑰ will often catch feathers or pieces of straw in the air.

One of the most remarkable adaptations for carrying food is the pelican's beak ⑱. The lower mandible of the beak is a large, elastic pouch of skin into which the bird can pack several pounds of fish. The young are fed on partly digested food regurgitated into this pouch.

In Australia and New Guinea there are several different kinds of bower-bird ⑲. The male bower-bird, as part of his courting behaviour, makes an elaborate structure of grass and twigs on the ground, which he ornaments with brightly coloured objects such as snail-shells, stones, and pieces of glass and metal. This 'bower' is not the bird's 'nesting' nest, which is of the normal type and is built in a tree.

# HISTORY OF GERMANY (part one)

IN 113 B C, according to legend, the people of northern Italy were startled to see wild-looking warriors 'tobogganing' down the snowy slopes of the Alps, sitting on their shields. They had long red or fair hair and blue eyes, and were tall and strong. They wore the heads of wolves and oxen on their helmets, and some of them had the spread wings of eagles attached to their iron caps. Many of these warriors were members of a Germanic tribe, the **Teutones,** and this was probably the first Germanic invasion of Italy. Fortunately for the Romans they had a brilliant general, Marius, who decisively defeated the invaders.

No one is quite certain where the name 'German' really comes from. 'Germania' was used by the Romans to describe the area east of the Rhine and north of the Alps settled by a race which came originally from northern Germany and Scandinavia.

As a retaliation for German invasions of Roman territory, **Caesar** led two expeditions against these people in 55 B C and 53 B C. But, wisely, he made no attempt to conquer them. However, his successors learned, to their cost, the dangers of trying to bring these fierce tribes into the Roman Empire. In A D 9 the Roman governor Varus was completely defeated in the Teutoberger Forest by the German **Arminius** (or Hermann). So the Emperor Augustus abandoned all thoughts of conquering the Germans and established the doctrine that the natural frontiers of the empire were the Rhine and the Danube.

Germany at this period was divided into many tribal groups. Between the 1st and 4th centuries these coalesced into greater tribal groups whose names were to be recorded on the map of Europe for 1,000 or more years: the Franks (France); Saxons (Saxony); the Alemanns (*Allemagne* – the French for Germany); the Lombards (Lombardy); Frisians, Thuringians, Swabians, and so on. The tribes were primitive, wild, and had little feeling of unity. They frequently quarrelled with each other and worshipped warlike gods such as Wotan, Donar, and Freyja.

*Bust of Arminius, who routed the Roman forces in the Teutoberger Forest*

In the first half of the 5th century some of these German tribes began to move westwards. They did so because 'the scourge of God' and his 'beasts on two feet' – Attila and his Huns (see page 586) – were also moving westwards. So in the 5th century the Saxons arrived in England and the Franks moved over the Rhine into Gaul. In Gaul a kingdom was set up under the Merovingian dynasty. The greatest Merovingian king, **Clovis** (481–511; see page 2100), ruled over a Frankish kingdom resembling in area the France of today. While the Franks assimilated Roman culture and civilisation, over the other side of the Rhine the Germanic tribes continued their warlike and primitive existence.

*Monument to Charlemagne – founder of the mediaeval empire*

In 751 the Merovingians were deposed and a new ruling house took over. These were the **Carolingians,** called after the greatest member of the house, Charlemagne (see page 42). Under the first three Carolingians the German people east of the Rhine were incorporated into the Frankish kingdom. In 800, with the coronation of Charlemagne, the title of the King of the Franks was changed to that of Emperor. But it was a short-lived empire. In 843, at the **Treaty of Verdun** (see page 2100), Charlemagne's three grandsons divided it among themselves. In this treaty the **Kingdom of the East Franks,** which stretched from the Rhine to the Elbe, was given to Lewis the German. This was the beginning of the Kingdom of Germany. Its territory was very similar to the territory of the earlier Germanic peoples. But it still had little unity or civilisation. Nor were Lewis or any of the early German kings effective rulers. But these early years of the German kingdom were very significant, for there emerged two factors which were to have a decisive effect on German history. First the great German **duchies** appeared. These were mainly based on the old tribal divisions (like the Saxons or Swabians) and their leaders (*duces* – hence dukes) were independent and independent-minded people. The second important factor was the establishment of the **electoral principle** of the German state. When the last Carolingian ruler of the East Franks died in 911 Conrad, Duke of Franconia, was elected King at a tribal meeting of the Saxons and Franks. From this developed the custom that the German King owed his title not only to his heredity, but also to his election by the most important men in Germany. In the 14th century this system was formalised.

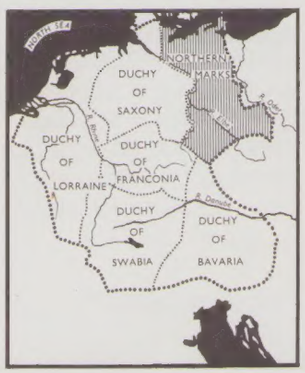
*Otto the Great crosses the Alps into Italy so to begin the Italian connection which was to prove disastrous for the German Empire*

Conrad was not a very effective king. But after his death, in 918, a strong man was elected – Henry the Fowler, Duke of Saxony. His dynamic son, **Otto I** (see page 742), succeeded him. By force of his own personality, and especially through his brilliant victory over the Magyars in 955 at Lechfeld, he came to control the dukes.

But Otto started a connection which was to prove disastrous to the German kingship. He ventured into Italy, and in 962 was crowned Emperor by the Pope. (The imperial title originally held by Charlemagne had lapsed.)

So by the 10th century the character of mediaeval Germany was already established. It was a Germany divided into great, independent duchies. There was a king-emperor whose power was dependent very much on the support he could obtain from the great dukes. The empire was now involved in Italian politics, as Italy was considered to be part of the empire. The fact that the Pope had bestowed the crown on the emperor began a relationship between the two which was to rend Italy and Germany with quarrels and be disastrous for the empire.

It is, therefore, hardly surprising that the mediaeval emperors were a series of brilliant failures. Otto I's son and grandson, Otto II and Otto III, both died in Italy after reigns which had been absorbed with the intricacies of Italian politics. In the 11th century the emperors became involved in quarrels with the Popes (see page 773). The quarrels continued in the 12th and 13th centuries, especially while the empire was under the Hohenstaufens (see page 2248). The Hohenstaufens produced a series of brilliant emperors, but all of them were too involved in Italian politics and with their imperial ambitions to establish any real control over Germany. Meanwhile, in England under the Angevins, in France under Philip Augustus (see page 499) and Louis IX (see page 1124), and in southern Italy under the House of Hauteville (see page 804) powerful and united kingdoms were being built up, and their rulers were no more talented than the Hohenstaufens. In fact, by 1250, when Frederick II, the last of the Hohenstaufen emperors, died, there had been few political advances in Germany since the days of Otto I. The legacy of the mediaeval German Empire is nothing less than one of the most glorious, fascinating, and tragic chapters in the history of Europe.




*The duchies under Otto I* ▶

**German emperors until 1250**
Otto I (the Great) 936–973 (see page 742)
Otto II 973–983 (see page 1604)
Otto III 983–1002 (see page 1604)
Henry II (the Saint) 1002–1024
Conrad II (the Salic) 1024–1039
Henry III (the Black) 1039–1056 (see page 773)
Henry IV 1056–1106 (see page 773)
Henry V 1106–1125 (see page 773)
Lothair II 1125–1137 (see page 2248)
Conrad III 1138–1152 (not crowned; see page 2248)
Frederick I (Barbarossa) 1152–1190 (see page 977)
Henry VI 1190–1197 (see page 1745)
Otto IV 1198–1212 (see page 960)
Philip II 1198–1208 (not crowned; see page 960)
Frederick II 1212–1250 (see page 609)

*Statue of the Emperor Frederick II*

*Indian women at work in the paddy fields, cultivating Asia's staple food, rice*

VARIETY and size characterise Asia. There are huge countries like India and China (the two most populous in the world), and small ones like Nepal and Kuwait, and there are people of many different races and religions. Asia possesses gigantic mountain ranges, such as the Himalayas, and great rivers like the Ganges, Irrawaddy, and Yangtze. It has tropical regions in the south-east, vast forests in the north, and enormous deserts in central Asia, northern India, the Middle East, and the Arabian peninsula.

Asia is the largest continent in the world. It occupies about one-third of the total land surface, stretching from the Ural Mountains in the west to Japan in the east, the Arctic in the north, Arabia in the south-west, and Indonesia in the south-east. About 1,300 million people – nearly two-thirds of the world's population – live there.

# ASIA: economy

The people of Asia are very poor, and the vast majority work in agriculture, gaining only a bare subsistence from the soil. Only Japan and Russia are really industrialised, although great progress is being made in China and, to a lesser extent, in India.

## Agriculture

The type of agriculture varies with the climate, but the two products most associated with Asia are rice and tea.

Rice is the major food of Asia and forms the basic diet of nearly half the people in the world. Over 90 per cent of all rice is grown in Asia and over 50 per cent in India and China alone. Rice is grown wherever the climate permits – in general in the warm, humid lands of south and east Asia. It is mainly grown on very small farms, and most of the labour is done by hand. Only a small amount of rice is put on the market, for most is consumed immediately by the farmers and their families. Where rice cannot be grown, other grains form the main crop. In north China, for example, wheat and millet are grown.

Although China produces more tea than any other country, India is the main exporter. Ceylon and Indonesia are also leading commercial producers of tea.

Livestock and dairy farming are not nearly so important in Asia as they are in Europe and America. India has more cattle than any other country, but there is no large meat-producing industry. Pigs and poultry are kept everywhere, and China has more swine than any other country in the world.

Cotton is a very important industrial crop in Asia, and after the United States the leading producers are India, China, and the USSR. Asia is also, as it has always been, the chief producer of silk, the main centres being Japan and the subtropical and tropical parts of China. Another textile fibre, jute, is also an extremely important crop in Asia. Nearly the whole of the world's supply (95 per cent) comes from two countries, India and Pakistan.

Asia is a major source of rubber, over 90 per cent of which comes from south-east Asia. The leading producers are Malaysia, Indonesia, Thailand, Ceylon, Vietnam, and Cambodia.

Fishing plays a vital part in the economy of several Asian countries, and the world's leading fishing nations are Japan and China.

*Economic map of Asia*

## Manufacturing

Industrial progress has made little headway in Asia except in the USSR and Japan, although there has been a remarkable growth recently in China. In most of the continent, manufacturing of basic necessities is done on a very small scale, usually in household workshops.

Japan produces iron and steel, chemicals, textiles, tools, automobiles, rubber goods, ceramics, and a great variety of other products. In China, heavy industry is developing in south Manchuria and other regions, and traditional cotton and silk textile industries are flourishing. Textiles also form the largest industry in India, though a few centres of heavy industry are developing there.

## Mineral resources

As Asian countries are chiefly agricultural, much of their mineral wealth remains undeveloped, and much of what is produced is exported.

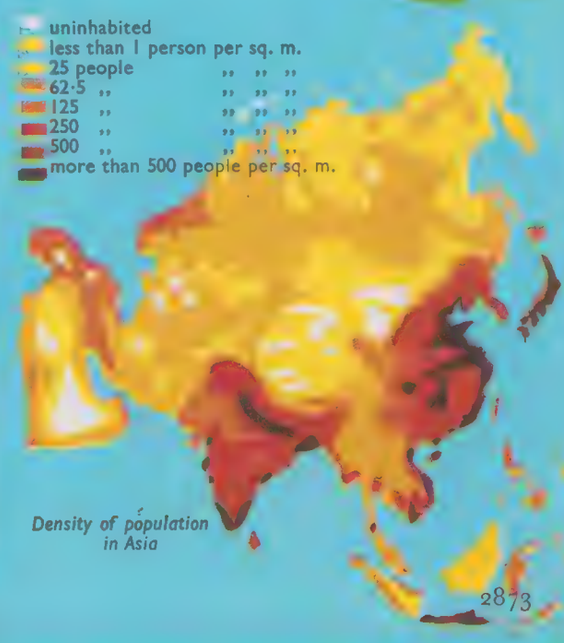
Coal is mined extensively in the Soviet Union, especially in Karaganda and the Kuznetsk basin, and there are great unexploited reserves in north-east Siberia. China's coal output is expanding in the provinces of Shansi and Shensi. Northern India possesses big coal resources, and Japan is one of Asia's main producers.

Asia produces great quantities of petroleum. Most oil comes from the Persian Gulf states and south-east Asia (especially Sumatra and Borneo), and Russian production is increasing rapidly.

Possibly the greatest iron ore reserves in the world occur in north-east India. China is now the world's fourth largest producer of iron ore, the main deposits being in southern Manchuria. Magnitogorsk in the Soviet Union is another great centre.

Copper is produced in Japan, India, and the USSR; lead and zinc in the USSR and Burma; gold in eastern Siberia and central India. Asia produces more tin than any other continent: Malaysia, southern China, and the USSR are all leading producers. Bauxite, nickel, tungsten, manganese, magnesium, mercury, sulphur, and many other minerals are all produced in Asia.

*Vegetation in Asia*




*Density of population in Asia*

# GRASS INTO MILK

THERE are 3 million milking cows in Britain. They produce 2,000 million gallons of milk each year – enough to provide every person in the country with a pint of milk each day. This milk, of course, is designed as food for calves rather than humans, but dairy farmers obtain the milk for human consumption by taking the calves from their mothers a few days after birth. The calves are given thinned milk enriched with milk substitutes, and they seldom seem to suffer from this modification of their diet.

The ability of the cow to convert a considerable proportion of her grassy diet into nutritious milk is the chief reason for the animal's great economic importance. Grass is utterly useless as a foodstuff for humans, because the enzymes of the human intestinal tract are unable to digest it. Milk, on the other hand, is extremely digestible and forms a very useful part of the human diet. It is particularly valuable in the feeding of children.

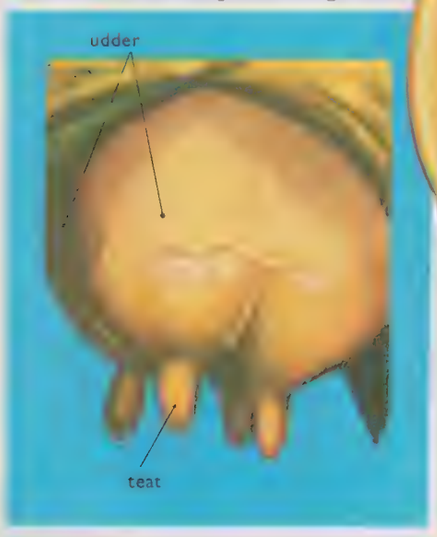
## A little anatomy

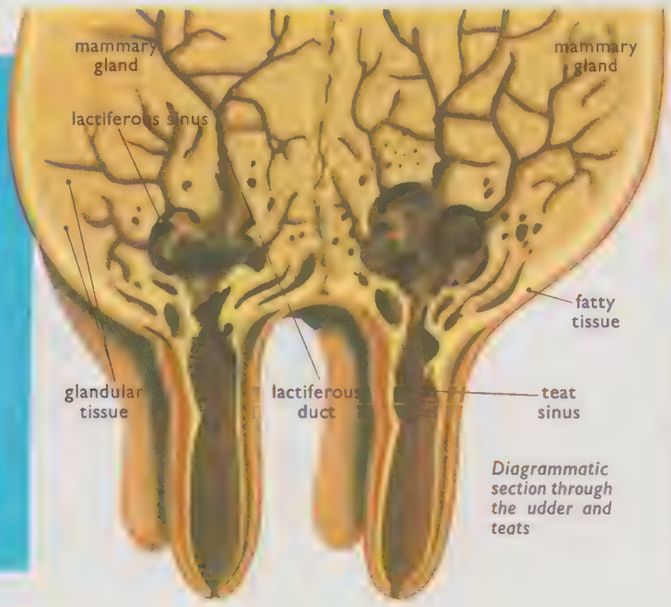
The milk-producing organs of the cow are her four mammary glands. They are arranged together at the hind end of the ventral abdominal wall and are surrounded by a covering of skin to form the *bag* or *udder*. From the undersurface of the udder hang four *teats* or *mamillae*, one for each gland. When the cow is suckled or milked the milk from the glands flows down the teats, and comes out of a small hole at the lower end. The udder and teats of a cow which is 'in milk' are large, and there are usually several easily visible veins running across the udder just beneath the skin. The udder of a heifer (a cow which has not borne a calf), or of a cow which is *dry* (that is, not in milk), is smaller, and the skin which covers it usually has a puckered and wrinkled appearance.

Each of the mammary glands, or *quarters* as they are called by the dairy farmer, consists of a mass of glandular tissue richly supplied with blood vessels. The milk-secreting cells are arranged in small groups called *acini*, and from each *acinus* there issues a tiny milk-carrying *duct*. The ducts unite with each other to form larger and larger ducts, until finally the *lactiferous ducts* open into a large cavity in the central part of the mammary gland just above the teat. This cavity is called the *lactiferous sinus*, and its function is to store the milk which runs down the ducts from the acini. Its walls are elastic, and, in consequence, its capacity is as much as a pint.

The lower part of the lactiferous sinus communicates with the *teat sinus* in the upper part of the teat. This is a much smaller cavity than the lactiferous sinus, and its capacity seldom exceeds 2 fluid ounces (about a wineglassful). From the lowest part of the teat sinus runs the *teat canal*, the duct through which the milk is conveyed to the small hole at the teat's end.

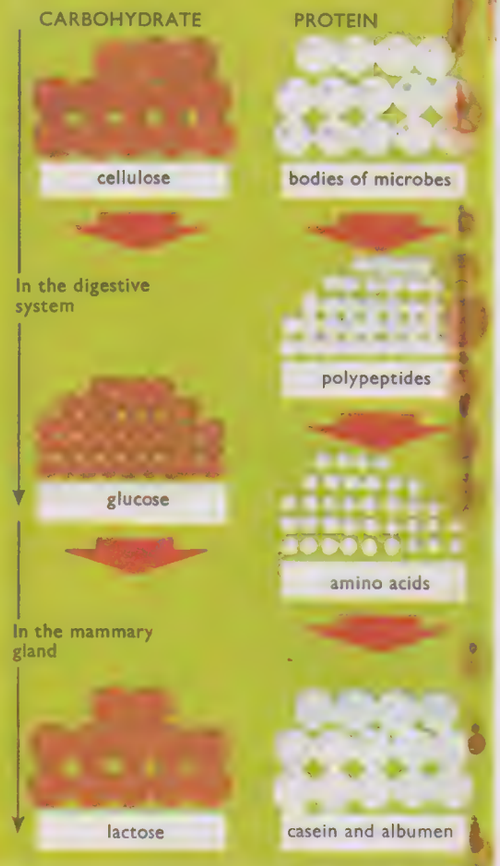
*Udder and teats of a milking cow*




*Diagrammatic section through the udder and teats*

In summer a cow's diet consists chiefly of grass, which the farmer supplements with a little ready-mixed food. This is known as cattle cake, and contains foodstuffs like proteins and starch. In winter hay replaces the grass, and kale and fodder beet are added. These foods contain a great deal of the vegetable fibre *cellulose*; and neither man nor the cow has suitable enzymes to digest this substance. But the part of the cow's stomach known as the *rumen* harbours incredible numbers of bacteria and protozoa, which attack the cellulose and break it down into usable foodstuffs. Some of these foodstuffs are used by the microbes themselves; others are used by the cow. When the microbes die their bodies are attacked by the digestive enzymes of the cow, and the products of this digestion are absorbed into the cow's circulation.

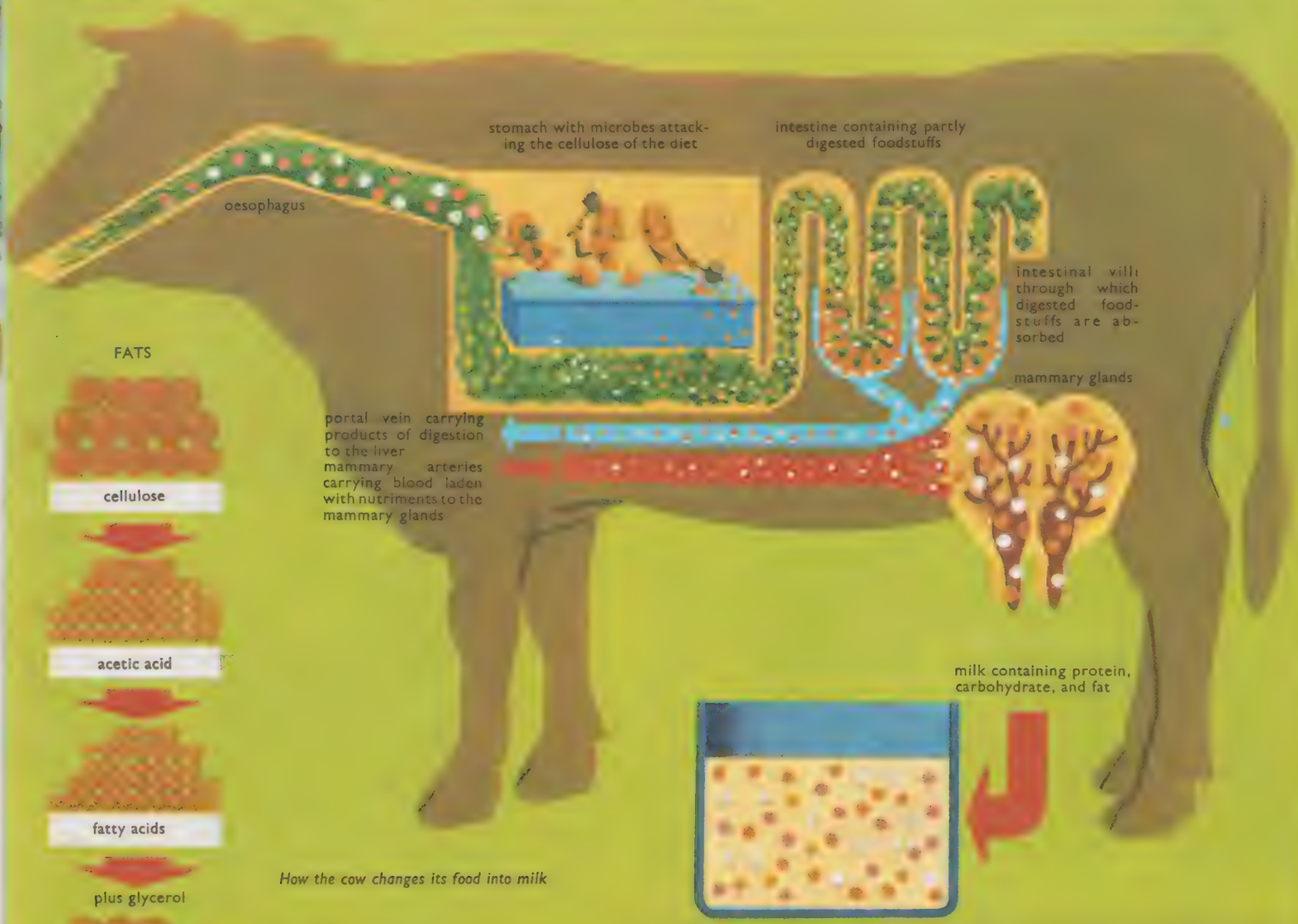



*DID YOU KNOW?*

1. *Sour milk is acidic.*
2. *About half the milk consumed in India comes from the buffalo.*
3. *One of the earliest biblical references to milk is Jacob's prediction in 1700 BC that Judah's teeth would be 'white with milk'.*

PROTEIN. The diet of the cow contains relatively little protein, but her supply of this foodstuff is greatly augmented by the bodies of the dead bacteria and protozoa, both of which, unlike the cow herself, can make protein from non-protein foodstuffs. In the cow's intestine the protein is digested via *polypeptides* to *amino acids*. These are carried in the blood to the mammary glands, where they join to form the milk proteins *albumen* and *casein*.

CARBOHYDRATE. The carbohydrate which makes up such a large proportion of the cow's diet comes chiefly in the form of cellulose, which consists of very many molecules of the sugar *glucose*, all joined together in a particular way. As we have seen, the microbes in the cow's rumen break down the cellulose and release much of the sugar, some of which passes through the bloodstream to the mammary glands. In the mammary glands are enzymes which convert some of the glucose into a very similar sugar, *galactose*. The molecules of glucose and galactose then join together in pairs to form milk sugar, or *lactose*.


stomach with microbes attacking the cellulose of the diet
intestine containing partly digested foodstuffs
oesophagus
intestinal villi through which digested foodstuffs are absorbed
mammary glands
portal vein carrying products of digestion to the liver
mammary arteries carrying blood laden with nutriments to the mammary glands
milk containing protein, carbohydrate, and fat
FATS
cellulose
acetic acid
fatty acids
plus glycerol
butterfat

*How the cow changes its food into milk*

FATS. Although the cow's diet contains very little fat, her milk contains about 3·5 per cent of this energy-producing foodstuff. The fat in a cow's milk is chiefly in the form of substances called *triglycerides*, complex molecules consisting of three *fatty acid* molecules all linked to one *glycerol* molecule.

As a result of the action of the microbes in the rumen on the cellulose in the cow's diet, a large number of different fatty acids are formed. The most important of these are the small molecules of *acetic acid*, for they are transported to the mammary glands where they are joined together to form the larger fatty acids which are present in milk. The glycerol molecule is quite a simple one, and is formed in the course of several biochemical processes which take place in the tissues. In the mammary glands, the large fatty acid molecules unite with glycerol to form the *butterfat* which rises to the top of the milk when it is left to stand.

THE COMPOSITION OF COW'S MILK

| | |
|---|---|
| Water | about 87 per cent |
| Protein (albumen and casein) | 3·6 per cent |
| Carbohydrate (lactose) | 4·9 per cent |
| Fats (triglycerides) | 3·5 per cent |
| Calcium | 0·1 per cent |
| Phosphorus | 0·1 per cent |
| Other substances | 0·8 per cent |

The milk of other mammals resembles that of the cow apart from differences in the amounts of the constituents.

# THE 'PYRAMIDS' OF THE NEW

*The colossal Pyramid of the Sun, built by the Toltecs as the central feature of their great ceremonial city, Teotihuacán*

FLIGHTS of stone steps, straight, wide, and often steep – this is the feature which immediately distinguishes the pyramids of the New World from those of the Old. These steps were the ceremonial route by which the priests ascended to the pyramid top where, within a temple, they often sought to appease their gods with human sacrifices.

### 'Modern' pyramids

Compared with the 4,000-year-old pyramids built by the Ancient Egyptians, the pyramids of the New World seem almost recent. The oldest are less than 2,000 years old, and some are only half that age. They were built, in the main, by three races. In the central plains of what is now Mexico, the *Toltecs*, and later the *Aztecs*, were the pyramid builders. In the north, the pyramids were the works of the *Maya*.

Grotesque stone-carved animals like this serpent's head decorated many of the Aztec buildings

*Map showing the more important New World pyramids*

### The Toltecs

The Toltecs were a highland race, and, indeed, this is the meaning of their name. Nevertheless it seems that they became attracted by the prospect of easier living on the plains and so they descended to central Mexico, probably about 1000 B C. By A D 200 they had advanced sufficiently to begin the construction of their magnificent temple-city, Teotihuacán.

Teotihuacán, which means 'The Place of the Gods', covered an area of about 8 square miles in the north of Mexico. Its greatest monuments, which rival even the pyramids of Egypt in size, are the Sun Temple and the rather smaller Moon Temple nearby. Each of these gigantic pyramids is flat-topped, each is stepped, and each has a great ceremonial stairway.

Toltec civilisation did not last. In about A D 900 the inhabitants of Teotihuacán migrated to the south and west, and abandoned their city to the neighbouring tribes.

### The Aztecs

In the middle of the 12th century the Aztecs came from the north-west. They first settled on a marshy island near the western edge of Lake Texcoco. This came to be known as Tenochtitlán, meaning 'Place of the Tenochs (or Aztecs)'. Within two centuries they had conquered all

## The Maya

The Maya occupied the broad peninsula of Yucatán which juts out into the Gulf of Mexico. This land was their home from as early as 2000 B C, but it was not until about A D 300 that they began to build their pyramids.

Among the chief Maya cities were Tikal in the south, where there were no fewer than eight pyramids, and Chichén Itzá in the north, where the Pyramid of Kukulcán was built. Maya builders, unlike their Aztec counterparts, used lime mortar in their work, and this enabled them to construct buildings of considerable complexity. At Chichén Itzá the pyramid is flanked on one side by the great Temple of the Warriors and on the other by a court in which a kind of 'basket-ball' was played.

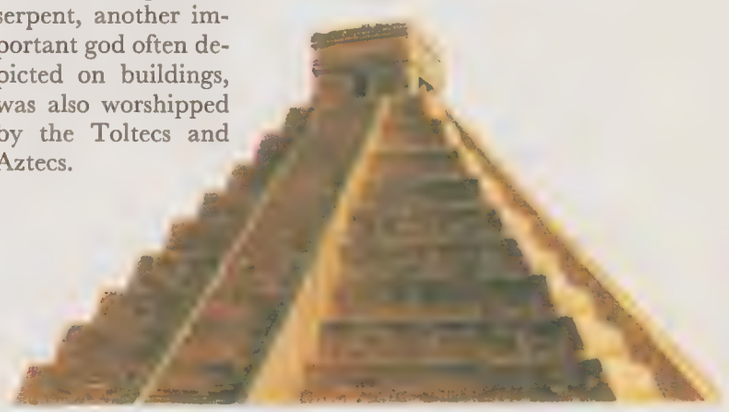
*The Aztec pyramid at El Tajín which had a niche for each day of the year cut into its sides*

*The smaller pyramids at Teotihuacán, recently restored*

Principal Mayan gods represented the sun and the moon. The plumed serpent, another important god often depicted on buildings, was also worshipped by the Toltecs and Aztecs.

the neighbouring tribes, and were the absolute masters of the whole region. They inherited the ruins left by the Toltecs and doubtless learned much of the art of building from them. They founded new cities on the central plain, and built many new pyramids. In the heart of their capital, Tenochtitlán (see page 442), they built their greatest pyramid, which they dedicated to the god of war. The base of the pyramid was 300 feet square, and the summit more than 300 feet high. A flight of 340 steps led to twin three-storied towers at the top which contained sacrificial altars where the priests offered the human sacrifices demanded by their cruel religion.

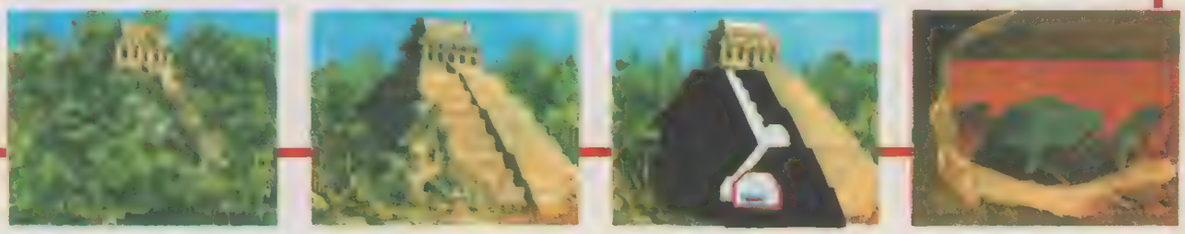
*Aztec dancer, wearing the traditional colourful quetzal feathers*



*The Temple of Kukulcán in the magnificent Maya city of Chichén Itzá*

### A MAYA TOMB IS DISCOVERED

In general it was agreed by archaeologists that the purpose of the pyramids of the New World was to support and dignify the temples built at the top. It was therefore of great interest when, in 1949, the Mexican archaeologist Alberto Ruy discovered in the temple at Palenque a hidden stairway leading downwards from the temple floor to an Egyptian-style tomb within the pyramid. In the tomb, guarded by the skeletons of six youths, lay the bones of a Maya chief.



*A Maya tomb is revealed*

# TELEGRAPH AND

*The American artist and scientist, Samuel Morse, transmits a message by telegraph. Behind him is the receiver on which the message is recorded*

'S O S . . . S O S.' Today we take it for granted that ships at sea can radio their distress and that help is not far away. But less than 150 years ago messages could only be sent by some form of noise, flare, or beacon – or by actually transporting them. It was not until man learned how to transmit messages by electricity that a whole new era in communications was opened up. This discovery – the invention of *telegraphy* in the mid-19th century – led to great things. Among them was radiotelegraphy. In the early years of the 20th century the floundering *Titanic* summoned help over the radio and Dr Crippen was arrested *en route* to Canada after a transatlantic telegraph had warned authorities of his attempted escape. These and millions of later instances are among the debts owed to the pioneers of telegraphy.

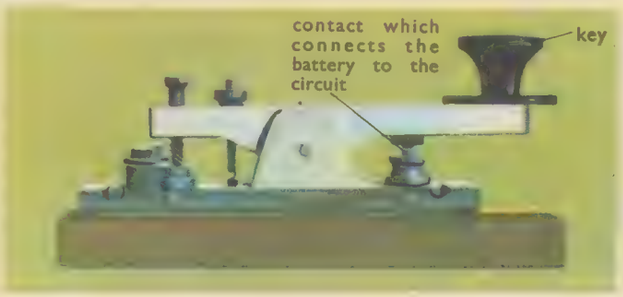
Telegraphy is based on the sending of electrical impulses through wires. An electric current can easily be sent through a wire by a battery, and the duration of the current can be controlled by switching the battery on and off. The wires at the other end can be connected to a *receiver* – an electromagnetic instrument designed either to make a sound like a buzz or a click, to ring a bell, to alter the direction of a magnetic needle, or to draw a line.

The first ever telegraph system was set up in London in 1837 by a scientist called Charles Wheatstone. His earliest system was very cumbersome, using five different lines, and he soon replaced it with a single-line system. The receivers of these early systems worked by deflecting magnetic needles.

While these advances were being made in England an American called Samuel Morse was developing his own telegraph. In his apparatus, which was first used in 1844, the electric current worked an electromagnet which caused a pencil to mark a line on a moving piece of paper. By regulating the length of the electrical impulses, Morse was able to produce long and short marks. He invented a code in which combinations of these long and short marks – known as dashes and dots – represented the letters of the alphabet. His code, known as the *Morse Code*, is used in a modified form in telegraphy today.

A simple telegraph set consists of a battery to provide the electric current, a wire or line to carry it to another place, a sending switch or 'key', and a receiving instrument. The current must return to the battery to complete the circuit, and it is often arranged for it to return through the earth. This is called an *earth return*.

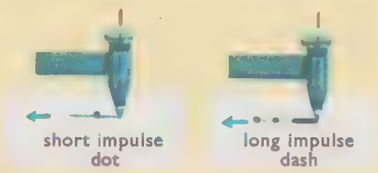
The instrument which sends out the signal is called the *transmitter*. In a manual telegraph the impulses are controlled by the *Morse key*, a small metal arm with a contact at each end and a pivot at its centre.




*A Morse key. The contacts at the front and rear of the arm can be seen. The spring which keeps the rear contact 'closed' is just behind the pivot*

When the key is pressed the contact at its front end touches another contact immediately below it on the base board, thus connecting the battery to the line, completing the circuit, and allowing current to flow to the receiver at the other end. When the key is not in use for transmitting, the contact at its rear end touches the contact immediately below it and connects to a receiver any signals being transmitted back along the line.

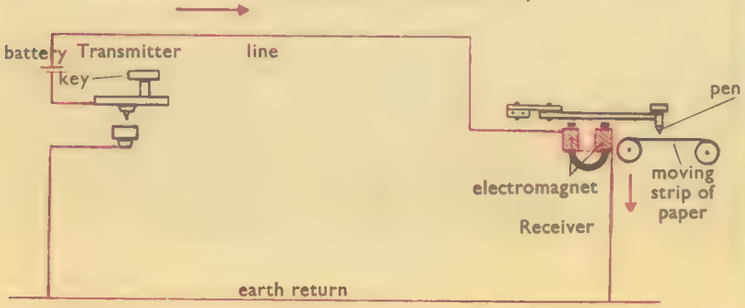
Early telegraph receivers had magnetic needles, which were deflected from a centre line as each impulse arrived from the transmitter. But this meant that the man receiving the message had to watch the dial at the same time as writing down the message, and, as a result, these receivers were soon superseded by ones which emitted sounds. Short and long impulses on these are distin-




*Pens used for recording telegraph signals*

*On the left are the letters of the Morse Code. They consist of signals which vary in length from one dot to one dot and three dashes, and the shorter signals correspond to the most frequently used letters. Above is a word spelled out in Morse*

*This diagram shows the simplest possible telegraph circuit in which messages can be transmitted in one direction only*



# TELEPRINTER

guished either by two different sounds or by the time which elapses between the sounds. Other receivers, like Morse's, draw *dots* and *dashes* with pens controlled by electromagnets.

## Duplex, quadriplex, and multiplex

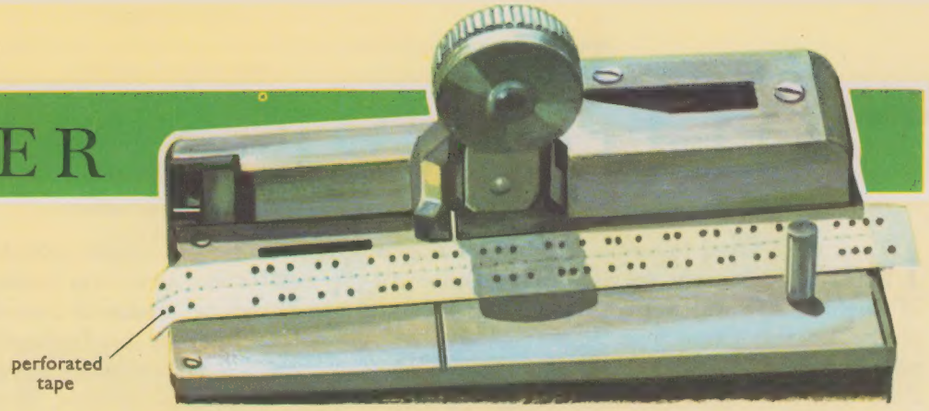
Telegraph circuits are costly to install and operate, and so many devices have been invented to increase the message-carrying capacity of individual lines.

In the *duplex* system a single line carries two messages at the same time, one in each direction. This is achieved by connecting both a transmitter and a receiver at each end of a line. In the more complicated *quadriplex* system two messages can be sent from each end at the same time. The complicated *multiplex* system can handle four or more messages at a time.

A rather different way of increasing the capacity of a telegraph line is to feed into it a number of electric 'carrier' currents of different frequencies. Telegraph signals can then be superimposed on each of these carriers. The signals can be sorted out by filters at the receiving end and then routed to separate receivers for decoding.

## Radiotelegraphy

Telegraphy between cities, and between countries separated by sea, is usually carried out by means of land-lines and submarine cables. This method is obviously impossible for ships at sea, and is therefore replaced by telegraph signals sent by radio (*radiotelegraphy*). Radiotelegraphy is less affected by distortion than *radiotelephony* (voice transmission), and can therefore be used when distance or atmospherics make satisfactory radiotelephonic contact impossible.



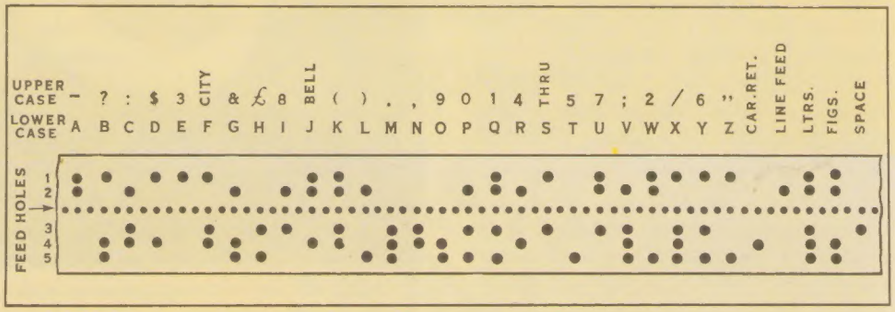

*The head of an automatic transmitter used for tape with two lines of holes*

## AUTOMATIC TRANSMISSION

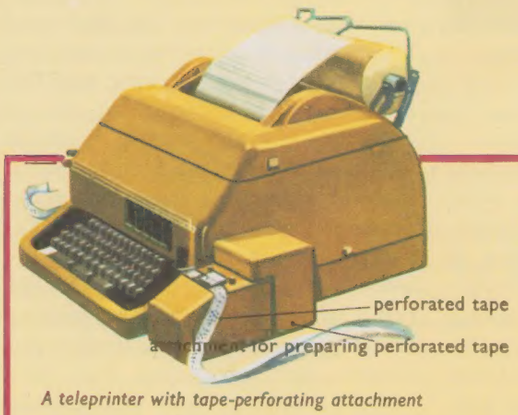
A skilled operator using a Morse key can transmit about 40 words each minute. A telegraph line can handle many more, so a single line can carry a great many messages if transmission and reception are speeded up. This is done by *automatic transmission*.

Messages to be transmitted are first encoded on a narrow tape of paper. The early code was based on the Morse Code, and a simple device punched two lines of holes in the paper. Two holes, one immediately above the other, represented a short impulse or dot; two holes, with the lower one to the right of the upper, represented a long impulse or dash. The completed tape was fed through a *transmitter* operating at several hundred words per minute. Since the transmitter could deal with tape much faster than it could be prepared, several people could use a single transmitter and line. Equally fast machines were needed to receive and record the signals. These were chiefly *reperforators* which prepared from the incoming impulses tape exactly like that fed into the transmitter. This could either be used to pass on the message or be fed into a decoding machine which produced a second tape on which the message was printed in Roman characters.

Today most automatic transmission systems use tape punched with a five-unit code, two of the holes being above and three below a line of feed holes. This system is used chiefly for transmission in submarine cables and for teleprinter services. The tape is prepared on a machine with a keyboard like a typewriter, or on a teleprinter with a special attachment. On receipt it is decoded into words in a single step, either on to ticker tape or on to a paper roll.


UPPER CASE – ? : $ 3 CITY & £ 8 BELL ( ) . , 9 0 1 4 THRU 5 7 ; 2 / 6 " CAR. RET. LINE FEED
LOWER CASE A B C D E F G H I J K L M N O P Q R S T U V W X Y Z LTRS. FIGS. SPACE
FEED HOLES 1 2 3 4 5

*Transmitting tape perforated with five-unit code*




*A teleprinter with tape-perforating attachment*

## The teleprinter

The teleprinter, or, as it is called in America, the teletypewriter, is an instrument used both for the transmission and the reception of telegraph messages.

The teleprinter has a keyboard much like a typewriter. When the operator presses a key a code combination of five units (see illustration above) representing the letter is sent down the line to the teleprinter at the other end. This signal causes the second teleprinter to select and print the same letter on a paper ribbon.

Teleprinters can transmit directly. It is also possible to record messages on a punched tape which can then be fitted to an attachment on the teleprinter. In this way a number of messages can be prepared in advance and then transmitted without a break.

The advantages of teleprinters are that they can receive messages when they are unattended at night, and that they provide permanent written records of business arrangements which have been completed with their aid.

In many countries special telegraph networks are available to connect teleprinters. Other systems connect teleprinters to each other through the ordinary public telephone exchange.

# PHILIP II OF SPAIN

IF you were asked to name the kings of England there is one you would probably forget: Philip of Spain, who married Mary Tudor in 1554, and for four years was known as King of England. He was not a proper king: he could not introduce Spaniards into the offices of the English Church or State, nor was he allowed to interfere in England's foreign policy. Moreover, it was laid down that if Mary died without heirs, his connection with England would be ended and he would cease to be styled King of England. Nevertheless, the marriage alarmed Mary's subjects. A woman as much in love as she could not fail to be greatly influenced by her husband, and it seemed as if England was in danger of becoming just another province of the Spanish Empire. Worst of all, Philip was a devout Catholic, and English Protestants trembled at the thought of an unending Catholic dynasty ruling England in the Spanish interest. They welcomed Mary's childless death in 1558, and the accession of the reputedly Protestant Elizabeth. But this itself brought a new threat. The mighty Philip, by now ruler of Spain, her New World empire, Naples, Milan, and the Netherlands, was transformed into England's arch-enemy. He longed for the day when he could invade England and bring her once more into the fold of the Catholic Church.

The prospect was indeed a frightening one. Philip, son of the great Charles V (see page 1530) and Isabella of Portugal, had assumed his array of titles early in 1556 at the age of 28 at a time when the Spanish star was nearing its zenith. Englishmen would have been happier if Spain's great enemy, France, had been strong enough to offer a challenge to Spain; but after the Peace of Cateau Cambrésis (1559) France settled down into a generation of religious wars which virtually eliminated her from European politics. In 1570 the Pope issued a bull excommunicating Elizabeth and urged both her own subjects and the great Catholic powers to depose her by force. The following year the great victory of Lepanto (see page 1540) enhanced Philip's prestige and released him from the menace of Turkey. It looked as if nothing could save England from the power of Spain.

*Philip – ruler of the first empire on which the sun never set*

Yet Spain had her weaknesses. A successful invasion of England might result in the accession of Mary Queen of Scots (see page 2640) to the English throne. She was Catholic, but also pro-French; and so, while she lived, an invasion was for diplomatic reasons almost ruled out. But the heel of the Spanish Achilles was religion. The grave, high-minded Philip was desperately unfortunate (and unfitted) to rule at a time when the forces of the Reformation and the Counter-Reformation were gathering their full momentum. Philip saw himself as the 'strong arm' of the Counter-Reformation but had the ability neither to conciliate nor defeat the opposition. Protestantism in Spain he could, and did, crush, but in the Netherlands it gained a hold. Protestant 'Sea Beggars' seized Brille and Flushing in 1572, and the great Dutch revolt against Spain began. To see his Netherlands subjects increasing in strength, and, as he saw it, heresy, broke Philip's heart. It also drained his treasury as he unavailingly tried to turn the tide. All the time his treasure-ships from the New World were being plundered by English seamen like Drake (see page 2856), and after 1585 Elizabeth was definitely committed to helping his Dutch enemies. Then, in 1587, Mary Queen of Scots was at last executed, and Philip, eager for revenge, was free to embark on his 'Enterprise of England'.

In 1588, the year of the Armada, Philip still seemed overwhelmingly powerful. Only eight years earlier he had annexed Portugal, together with her empire in Brazil, the East Indies, West Africa, and Ceylon, and so become the ruler of the first empire on which the sun never set. Yet Spain – unable to defend her own gigantic empire – could not stop English seamen plundering former Portuguese colonies almost as they liked. In fact Spain was visibly weakening when, in 1588, her huge Armada set sail for England. Its total failure (see page 2857) underlined the Spanish decline and marked the true end of the 'Glorious Century of Spain'.

Philip's reign ended amid unrelieved gloom. His efforts to aid Irish rebels against Elizabeth proved abject failures, and he was unable to prevent the anti-Habsburg Henry of Navarre coming to the throne of France in 1589. The independence of the Netherlands was becoming more assured with every year. England was Protestant; France was united once more. Thus it was with his policies collapsing around him in ruins that, in his grim, bleak palace of the Escorial, he died a terrible death in the agonies of a tormenting disease on 13th September 1598.

## Seeds of decay

In his time Philip was accused of almost every conceivable villainy, from gross immorality to the murder of his lunatic son, Don Carlos, in 1568. The first was certainly, the second almost certainly, unfounded. In fact there was much that was noble about Philip, both in his unswerving devotion to his faith and his sacrifice of all personal comforts to his royal duties. No king, and few men, worked harder. For 16 or 17 hours a day this mighty sovereign would sit alone in the Escorial, reading and annotating every document or despatch in minute detail. Yet he had no idea of how to delegate work or responsibility, with the result that, despite his prodigious labours, Spanish administration was chaotic, and paperwork was years behind schedule. None of the faults in the Spanish economy or society was reformed, and while Philip's reign saw the bloom of greatness, the seeds of Spain's later utter decay are also clearly to be found.

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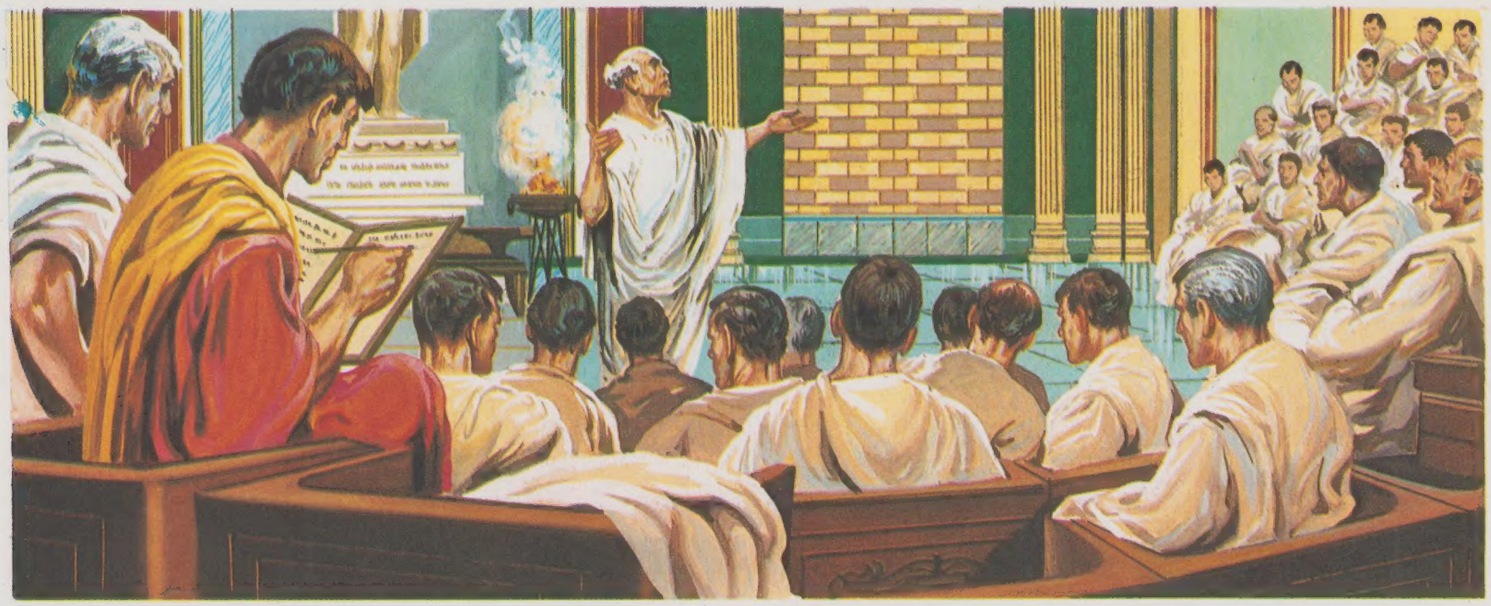

*At a meeting of the Senate a team of stenographers, using Tiro's shorthand, record the speaker's words*

Since the mid-19th century secretarial work, particularly in offices, has changed considerably. Three factors have caused this: the invention and spread of really practical forms of shorthand; the production of the first office typewriter by Remington in 1873; and the emancipation of women. The work of writing letters, accounting, and keeping records used to be done laboriously by hand, and women were unknown in offices. Today almost all secretaries are women, and the use of shorthand and copying, accounting, duplicating, and other office machines makes it possible for businesses to be run at a pace unthought of a hundred years ago.

## How shorthand began

The earliest organised system of shorthand or stenography (from the Greek words meaning 'narrow writing') was devised by Tiro, at first a slave but later freed by his master and friend Cicero, the great Roman orator. Tiro listened to all his friend's speeches, and it was probably his desire to keep a record of them that led to the invention of shorthand.

Both the Ancient Greeks and Romans sometimes used an abbreviated form of longhand, examples of which are found on their coins and monuments. Tiro studied these, and worked out a system of shortened or cut-down Roman letters. He used just the initial letters for some words, and abbreviated or omitted case-endings. His system, known as *ars notaria* (the art of notes), was taught in the Roman schools and practised by scholars, lawyers, and politicians. It was also used to record the words of the early Christians.

## Rediscovery

During the Dark Ages Tiro's system was forgotten, but with the rediscovery of Roman learning in the 11th century his shorthand came back into use, to remain popular for 800 years. As recently as 1849 a new adaptation was published by Gabelsberger, a German, whose system is widely used in continental Europe today.

*A simple form of shorthand from a boundary stone of the 2nd century B C. In full it would read:* Caius Sempronius Tiberi filius; Appius Claudius Cai filius; Publius Licinius Publii filius. Tres viri agris iudicandis adsignandis (*Caius Sempronius, son of Tiberius; Appius Claudius, son of Caius; Publius Licinius, son of Publius; the three men responsible for the award of the land*)

No. 180 Volume 15

# Knowledge

Printed in Great Britain by Purnell & Sons Limited
Paulton, Nr. Bristol

Published by arrangement with
Fratelli Fabbri Editori
Milan

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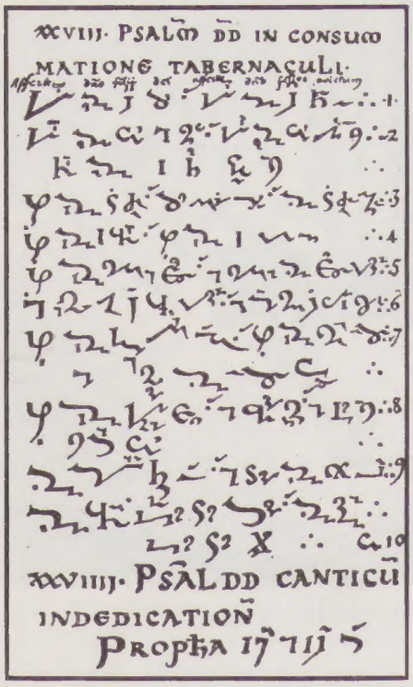
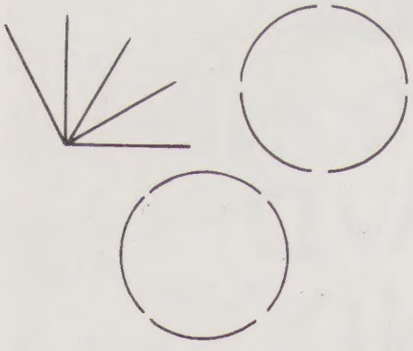
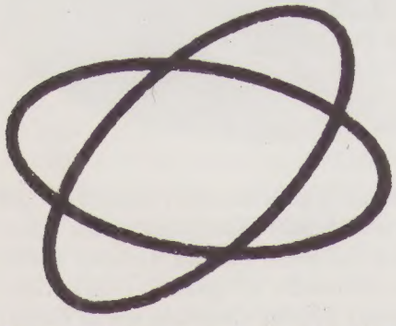



*Shorthand in the 8th century – the 28th Psalm in Tiro's system*



*The geometric forms from which the strokes of Pitman's alphabet are derived*



*Gregg used these two ovals as the base for his alphabet*

## THE TWO SHORTHAND SYSTEMS MOST WIDELY USED TODAY

Many English scholars have produced stenographic systems. Since the 16th century about 25 systems have been published, some original and some adaptations of previous systems. One was a collection of symbols – a different one for each word – that would require a superhuman memory. But two systems published in the 19th century achieved immediate popularity and are now in general use throughout the world, particularly in English-speaking countries. These are Pitman's and Gregg's.

### Pitman's 'stenographic sound-hand' and 'phonography'

Sir Isaac Pitman (1813–1897) was a schoolmaster and a keen shorthand writer. He developed his own system, which he taught to his pupils and published in 1837 under the name 'stenographic sound-hand'. In 1840 Pitman published an improved version, called 'phonography or writing by sound', in the form of a pamphlet from which other people could teach themselves. This 'Penny Plate', as it was called, is illustrated in the next article.

In Pitman's shorthand most words are written phonetically – that is, by the way they sound and not by the way they are spelled. The consonants are represented by thick or thin strokes of the pen at certain angles, all of which are shown in the diagrams below, left. The vowel sounds are indicated by dots or dashes in three positions, and the position of the whole word, or outline (above, on, or below the line), is determined by that of the first vowel. Special shortened forms are used for words and phrases that occur frequently, and several outlines can be joined together to give added speed when writing. This system can be used equally well for taking down foreign languages. In Great Britain today there are about 10,000 teachers of Pitman's shorthand, through whose hands pass some 250,000 students each year.

### Gregg's 'Light-Line Phonography'

John Robert Gregg (1867–1948) was, like Pitman, a keen student of the shorthand systems then in existence. He determined to invent one that had all their merits but none of their faults and published the result, *Light-Line Phonography*, in 1888 in Glasgow, where he also founded his first shorthand school. Gregg took the two ovals shown on the left as his base, and from these curves formed an alphabet in such a way that the letters joined together easily and smoothly, in the combinations in which they normally occurred in the English language. In 1893 Gregg went to the United States, where his system was already establishing itself. He set up shorthand schools, and his students began to win national awards that brought the Gregg system valuable publicity.

As a result, Gregg's shorthand is now the standard system taught and used throughout the Americas, although it is not widely used in Great Britain. It has also been adapted for use in foreign languages.

*Samples of shorthand: (top) Pitman's; (bottom) Gregg's*

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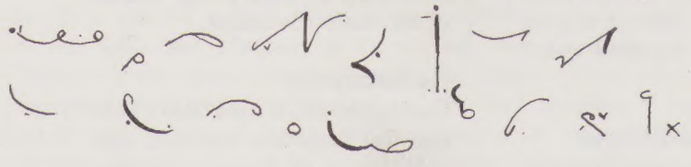

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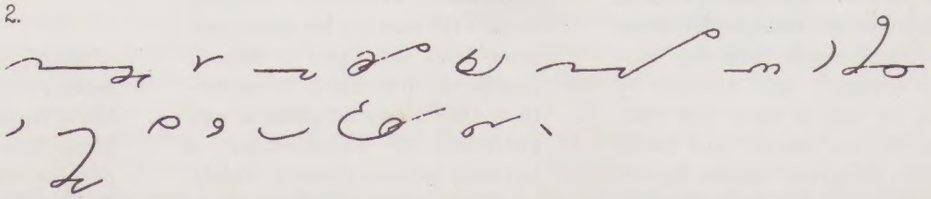

*Common sense is the most widely shared commodity in the world, for every man is convinced that he is well supplied with it.* René Descartes (1596–1650)